Forest Health Protection
Pacific Southwest Region

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To: Lee Johnson, Acting Forest Supervisor, Mendocino National Forest

Subject: Biological Evaluation of Smokey Project Area, Grindstone Ranger District, Mendocino National Forest (FHP Report No. N12-02)

At the request of Chad Atwood, Pete Angwin (Plant Pathologist) and Cynthia Snyder (Entomologist) visited the Smokey Project Area on the Grindstone Ranger District on October 24, 2011. Pete and Cynthia were joined by Chad Atwood (Silviculturist), Nancy Mulligan (Vegetation Management Specialist), Vicki Stoll (Planning Officer), Gary Urdahl (Silviculturist) and Lauren Johnson (Botanist) of the Mendocino National Forest. Three Project Area Units (1, 24 and 27) were visited. Chad recently found fruiting bodies of *Heterobasidion occidentale*, the causal agent of Heterobasidion root disease, in true fir stumps in several of the project units. Declining, dead and dying white and red fir was noted near several of the stumps. The purpose of the visit was to provide guidance on whether or not treatment of new stumps that would be created during the thin is needed to reduce potential spread and intensification of the root disease. Treatment would be with an EPA-registered borate compound (either Sporax® or Cellu-Treat®), applied directly to the top surface of freshly-cut stumps according to label direction.

Background

Parts of the Smokey Project Area are in the Buttermilk Late-Successional Reserve (LSR), and parts are in matrix land. The intent of the Smokey Project is to thin the units in order to provide greater resilience to insects and disease, reduce fire hazard, and especially in LSR areas, to promote wildlife habitat. An Environmental Assessment was prepared to address the thin, but with the discovery of *H. occidentale* in many of the units of the project area, the potential impacts of Heterobasidion root disease must now be considered.

H. occidentale (which until recently was known as “the S-type biological species of *Heterobasidion annosum*”) affects true firs, giant sequoia, hemlocks and Douglas-fir). Douglas-fir is only rarely affected in California. The related fungus, *Heterobasidion irregulare* (which until recently was known as “the P-type biological species of *H. annosum*”), which affects pines, incense-cedar, western juniper, pinyon and manzanita, is not known to be present in or near the Project Area. *H.occidentale* does not infect the tree host species of *H. irregulare*, and vice versa.

Heterobasidion root disease spreads to new host trees in two ways: 1) from infected host trees to uninfected host trees along root underground root contacts, and 2) by aerial spread of spores to freshly cut stump surfaces or recent wounds, followed by fungal growth through the stump’s roots to adjacent hosts via underground root contacts. *H.*

irregulare and *H. occidentale* are also both able to saprophytically colonize stumps of non-host conifer species, but only *H. occidentale* is subsequently able to infect live host tree species from colonized non-host conifer stumps. In addition, because *Heterobasidion* can't compete well with other microbes, the fungus is not transmitted to new hosts from spores or smaller pieces of infested root debris in soil, nor is it able to infect stumps that are more than a few days old.

While the proposed thins would limit the spread of the root disease by selectively removing true fir over non-host species, treatment of stumps with a borate compound now needs to be considered in order to limit aerial spread of the fungus to freshly-cut stumps and subsequently into adjacent living fir. Treatment of stumps with borate compounds has been shown to be at least 90% effective in preventing stump infection, thereby stopping aerial spread of the pathogen. Current Forest Service Handbook direction suggests the immediate treatment (at the very least, within two days) of all freshly-cut conifer stumps 14-inches or larger within stands that are lightly or moderately infested with Heterobasidion root disease. Treatment of all species of conifer stumps is recommended because of the ability of *H. occidentale* to infect non-host conifer stumps and subsequently infect living true fir, giant sequoia or hemlock host trees. However, because borate compounds do not eradicate the fungus or stop disease spread from stumps that are already infected, treatment of stands that are already heavily infested has only limited effectiveness. The decision to treat is a line officer decision, but where the effectiveness is questionable, the decision should be made with consultation with a Forest Health Protection pathologist.

Observations and Recommendations

Unit 1

Unit 1 is 33 acres in size, 13 of which is in the Buttermilk LSR. It is located at N39^{o} 44.242', W122^{o} 50.726'. Vegetation in the stand consists mostly of white and red fir, with many in the 40 and 50-inch diameter at breast height (DBH) size classes, along with scattered large ponderosa pine, sugar pine and incense cedar, some as large as 60+ inches DBH (Figure 1). Current basal area (BA) is about 270ft^2/acre, with 500 trees per acre (TPA) and 80% canopy cover. The proposed treatment prescription calls for a thin from below, removing much of the smaller stock (particularly the white fir) to better provide late seral stand conditions and foraging habitat for the northern spotted owl. Overstory canopy closure would be reduced to approximately 40%.

The proposed treatment would create many large conifer stumps, which could easily become colonized with *H. occidentale*. However, on walking through the stand, I found that many firs throughout the stand exhibited signs of decline (shortened leaders, chlorosis and signs of attack by the fir engraver beetle, *Scolytis ventralis*. Large stumps (14-inches or larger in diameter) were present throughout the stand. Chad estimated that there were at least 20 stumps and 29 snags per acre that were 29" or larger in diameter. On inspecting the stumps, I found that most of the fir stumps either had *H. occidentale* fruiting bodies on the inside surfaces or exhibited the laminant decay typical of infection with *H. occidentale* (Figure 2). Because the unit appeared to be already heavily infested, treatment of freshly cut conifer stumps with Sporax® or Cellu-Treat® would have only limited benefit. Treatment could be done as "cheap insurance" to provide the maximum amount of protection possible, but would only prevent the infection of firs that are not yet infected or have no infected trees or stumps nearby.

Figure 1. Vegetative conditions at Unit 1, Smokey Project Area

Figure 2. White fir stump in Unit 1 with decay and fruiting bodies of *Heterobasidion occidentale*

Unit 24

The characteristics of Unit 24 (located at N39^{o} 46.573', W 122^{o} 53.348') were very different from those of Unit 1. While the species composition of the overstory was similar to Unit 1 (mostly white fir with scattered incense cedar, Douglas-fir and sugar pine), the trees were smaller and younger (Figure 3). Chad measured this unit along with adjacent Units 25 and 26, so the following figures are a composite of the three. The units currently have a combined BA of 236ft^2/acre, with 80% canopy closure and 440 TPA. Of this, approximately 13 TPA are larger than 29" DBH and 4 TPA are larger than 39" DBH. In addition having younger and smaller overstory trees, Unit 24 had far fewer stumps and snags than Unit 1. However, while walking through the stand, Cynthia, Nancy and I found *H. occidentale* fruiting bodies in about 90% of the white fir stumps that we inspected (Figure 4). However, since there were far fewer stumps in the unit than in Unit 1, the unit was at best, only moderately infested. Post-thinning application of Sporax® or Cellu-Treat® to stumps 14-inches or larger would be effective in preventing the establishment of new root disease centers.

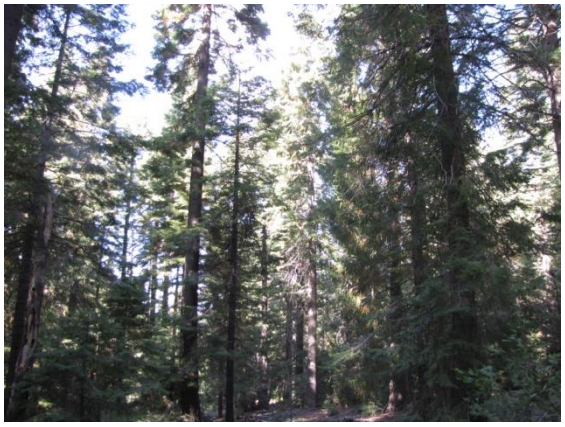

Figure 3. Vegetative conditions at Unit 24, Smokey Project Area

Figure 4. Fruiting bodies of *Heterobasidion occidentale* in a white fir stump in Unit 24, Smokey Project Area

The proposed prescription for this unit is similar to that of Unit 1. The proposed thinning would reduce the BA to 150ft^2/acre and discriminate against the white fir, while retaining the best ponderosa pine, Douglas-fir and incense cedar. Most of the trees that would be removed would be 20-30-inches DBH, and the canopy closure would be reduced to 60% (and 40% in Unit 26). Such a treatment would enhance the vigor of the remaining trees, improve their resiliency to attack by Heterobasidion root disease, fir engraver beetle and other diseases and insects, and treatment of stumps with borate would help reduce the establishment of new root disease infestations.

Unit 27

Located at N39^o 46.620', W122^o 53.898', the overstory of Unit 27 is composed mostly of Douglas-fir, ponderosa pine and sugar pine, with scattered white fir (Figure 5). The BA of the unit is 200ft^2/acre, with 60% canopy closure. The proposed thin would reduce the BA and percent canopy closure to approx. 125-150ft^2/acre and 40% respectively. Because of the unit has more pine and Douglas-fir in relative to true fir, Heterobasidion root disease is less of a concern than in the other two units. However, after checking approximately 30 stumps of all species, Cynthia found a *H. irregulare* fruiting body in one white fir stump. Treatment of freshly-cut conifer stumps 14-inches or larger would help to prevent the establishment of new Heterobasidion root disease infestations in the white fir as well. However, since there is far less white fir in this unit than in Unit 24, the treatment is less essential, but could be considered as a good, relatively inexpensive preventative measure.

Figure 5. Vegetative conditions at Unit 27, Smokey Project Area

Conclusions

It is worth noting that in all of the stump inspections that were done, both on Oct. 24 and by Chad on other days, *Heterobasidion* fruiting bodies have not been found in any pine or other non-true fir stumps. In addition, the pines in the units appear to be in relatively good condition. It thus appears that the only species of *Heterobasidion* present in the project area is *H. occidentale*, which as was stated before, is specific to true fir, giant sequoia and hemlock.

In most units, the proposed thinning treatments should help to provide greater resiliency to insect and disease attack, reduce fire risk and put the stands on track to provide the desired wildlife habitat. Because Heterobasidion root disease is widespread in the project area, most units (those that are uninfested, or lightly or moderately infested with *H. annosum*) would benefit from the treatment of freshly cut stumps. However, in the case of Unit 1, which is heavily infested with *H. occidentale*, treatment of stumps with borax would only have limited effectiveness in preventing new infections. In addition, the impacts of Heterobasidion root disease may likely prevent the stand from maintaining the late seral stand characteristics that are desired for spotted owl habitat.

In contrast, Units 24 and 27 will receive greater benefits from the thin, and because the levels of Heterobasidion root disease are low to moderate, treatment of freshly cut stumps with borax will be effective and are recommended. However, because of the relatively low percent of white fir in Unit 27, stump treatment is less essential, but is a good preventative measure.

Chad Atwood is commended for recognizing the potential for Heterobasidion root disease to be a problem in the Smokey Project Area and bringing it to my attention. While Chad gained a better feel for how much disease is present in a only few of the project units, he also now has a better idea of what kinds of stands will benefit from borax treatment of stumps and which will only have limited benefit. Chad has subsequently applied this information to the other units of the Smokey Project Area, can now be applied to the other units, so the decision to treat or not to treat can be made with more certainty so the proposed treatments will more likely produce the stated project objectives.

If you have any questions regarding this report or need additional information, please contact me at 530-226-2436.

/s/ Pete Angwin

Pete Angwin
Plant Pathologist
Northern CA Shared Service Area

CC: Chad Atwood, Nancy Mulligan, Gary Urdahl, Vicki Stoll, Linda Angerer, Lauren Johnson, Phil Cannon